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RESEARCH ARTICLE

Examination of cognitive appraisals, irrational beliefs, and challenge and threat evaluations in the prediction of tournament affective states and performance of competitive elite Indian golfers

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Abstract

Researchers have intimated that cognitions and emotions can change in the lead up to important events. However, previous research has adopted atemporal cross-sectional designs, making it challenging to understand how cognitions and emotions unfold in the lead up to a competition. In the current study, we extended previous research by examining the temporal patterns of cognitive appraisals, irrational beliefs, and challenge and threat evaluations in predicting pre-competitive affective states (hedonic balance and anxiety) in the lead up to an actual competition, among competitive elite Indian golfers (N = 107). We adopted a within-subjects repeated-measures design and collected data in the lead up to an actual golf tournament, at three timepoints; 1 week before (T1), the night before (T2), and an hour prior (T3). Self-reported measures of cognitive appraisals, irrational beliefs, challenge and threat evaluations, affect, and anxiety were completed. Also, objective golf performance was collected from participants. Crossed-lagged path analysis did not find a causal effect for irrational beliefs on any of the variables across the three time points. On the other hand, hierarchical multiple regression analysis determined that changes in irrational beliefs predicted changes in cognitive appraisals, threat evaluation, cognitive and somatic anxiety, and the directional interpretation of anxiety. The findings of temporal patterns in the current research indicated that sport psychologists should consider the dynamic nature of antecedent cognitions and affective states in the lead up to competition, and accordingly provide adequate support to the athletes. Further, limitations and future research is discussed with reference to the results.

KEYWORDS
affective states, cognitive appraisals, golf, irrational beliefs, performance, temporal

1 | INTRODUCTION

Participating in competitive sport can be an extremely stressful experience for athletes, and is associated with a gamut of emotions (Nicholls et al., 2012). Golf has been recognized as perhaps the most challenging of all sports in terms of mental control, and can generate emotions of high intensity (Bunker, 2006). Therefore, it is essential for researchers to try to understand how affective states are generated among golfers in the lead up to competition, and whether and to what extent these affective states impact upon performance, in order to formulate useful methods for athletes to learn to manage these psychological states.

1.1 | Theoretical background

Whilst there is recognition that affective states in sport are highly influential for performance (e.g., Lundkvist et al., 2021), there is a need to more comprehensively study how affective states are shaped by cognitive antecedents. Previous research within golf has explored cognitive appraisals, emotions, coping, and performance (e.g., Nicholls et al., 2005; Nicholls et al., 2010; Whitehead et al., 2016), with indications that cognition plays an important role for how golfers approach competition, and how they perform. But previous studies have often studied these cognitive antecedents separately and independently. That is, research has not yet captured the complexity of how affective states arise through cognitive antecedents, and how this constellation of cognition and affective states impacts upon performance. Whilst past research has advanced our understanding of golfer's psychological approach to performance, past research has included smaller sample sizes, thus limiting generalizability (e.g., Whitehead et al., 2016). But recent research (Chadha et al., 2019) has proposed a more comprehensive model (see Figure 1) to understand the generation of affective states and the influence this may have on golf performance through a complex interaction of antecedent cognitive appraisals, irrational beliefs, and challenge and threat evaluations.

Studying a large population of golfers competing at different competition levels, Chadha et al. (2019) explored the cognitive antecedents to pre-competitive affective states among golfers through the integration of Lazarusian cognitive appraisal theory (CAT; Lazarus, 1991), Ellisian irrational beliefs (Ellis, 1994), and challenge and threat evaluations (TCTSA-R; Jones et al., 2009; Meijen et al., 2020). The path analytic findings reported by Chadha et al. (2019) revealed that cognitive appraisals were negatively associated with irrational beliefs. The study of irrational beliefs in sport literature is growing, and there is recognition that greater irrational beliefs predict and are associated with a range of deleterious outcomes such as psychological distress (Turner et al., 2019), anger (Turner et al., 2018), burnout (Turner & Moore, 2016), poorer performance under pressure (Mesagno et al., 2021; Nejati et al., 2022), and poorer mental wellbeing (Jooste et al., 2022). Derived from Rational Emotive Behavior Therapy (REBT, Ellis & Dryden, 2007), irrational beliefs are characterized as tacit ideas about the world that are rigid, illogical and extreme (Turner, 2022), and play a significant role in determining emotional responses to adverse events. As such, once an event is appraised as adverse, irrational beliefs exacerbate and shape emotional responding. There is a growing body of research that places irrational beliefs within the conceptual framework of Lazarus' CAT (e.g., Chadha et al., 2019; David et al., 2002; Turner, 2022). According to CAT (Lazarus, 1999; Lazarus & Folkman, 1984), information processing includes a transaction between the goals of the individual and the representation of environmental encounter. Briefly, CAT comprises primary appraisals which are concerned with the extent to which the encounter is (a) relevant to one's well-being (motivational relevance), and (b) congruent with one's goals (motivational congruence). CAT also comprises secondary appraisals which concerns one's resources and options for coping with the encounter (Smith & Lazarus, 1993). The primary and secondary appraisals combine to form different core-relational themes that shape emotion. The association found between cognitive appraisals and irrational beliefs in Chadha et al. (2019) closely aligned with and extended previous research in non-athletic populations, which evidenced the important role of irrational beliefs alongside cognitive appraisals in the prediction of affective states (David et al., 2002, 2005). Chadha et al. (2019) offers an original comprehensive model that could be tested within the golfing population to gain a comprehensive understanding into how affective states occur through a complex interaction of cognitive antecedents and allows the current study to build upon it. In addition, the current study constructs upon the foundation laid by previous studies (e.g., Moore et al., 2012; Moore et al., 2013) that established significant associations between challenge and threat, anxiety and performance.

Chadha et al. (2019) also found that stronger irrational beliefs were associated with greater threat evaluation. In addition, serial multiple mediation analysis showed that challenge and threat evaluations a temporally mediated the relationship between cognitive appraisals and affective states alongside irrational beliefs, such that a more negative cognitive appraisal (i.e., higher motivational relevance, higher motivational incongruence, lower coping) was related to greater negative affect and greater anxiety, through irrational beliefs and challenge and threat evaluations. In Chadha et al. (2019), the most notable extension of David et al. (2002, 2005) work was the inclusion of challenge and threat evaluations alongside irrational beliefs and cognitive appraisals. Challenge and threat evaluations are important constructs in Lazarus's appraisal process and are labeled as relational meanings in his appraisal theory (Lazarus, 2000). Specifically, athletes who respond positively to the competition, evaluate it is a challenge, whereas, those who respond negatively to the competition, evaluate it is a threat. Chadha et al. (2019) considered both cognitive appraisals and challenge and threat evaluations to provide a more comprehensive predictive model of affective states among golfers. For conceptual edification and clarity, in the present study (as is the case in Chadha et al., 2019), cognitive appraisals are operationalized in Lazarusian terms as primary and secondary appraisals, whilst challenge and threat evaluations are operationalized

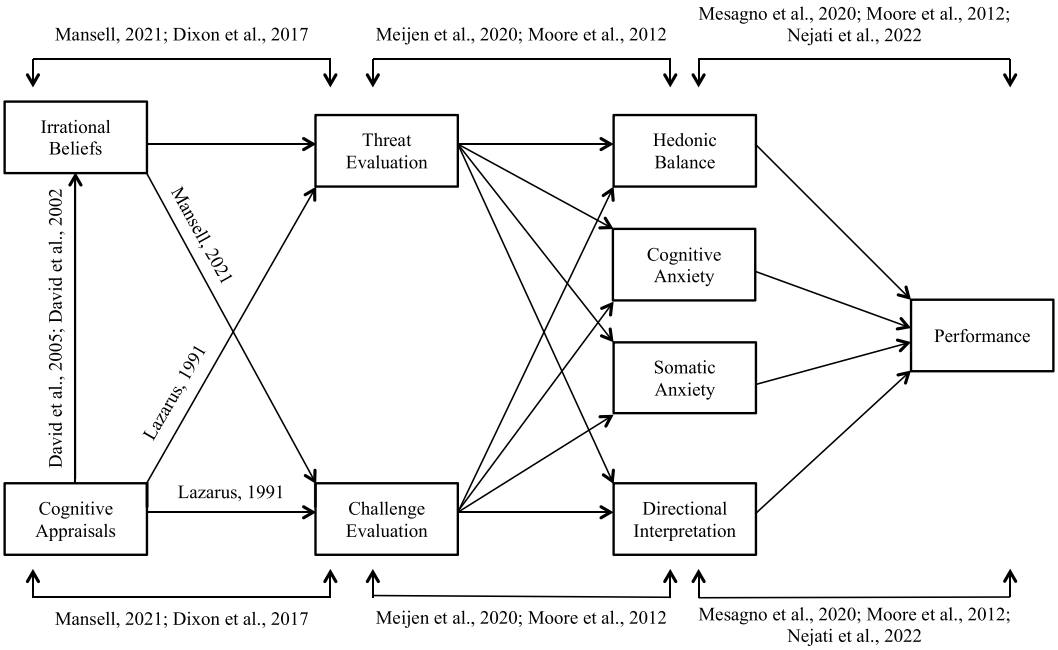

FIGURE 1 Proposed theoretical model in Chadha et al. (2019).

as end states of this appraisal process (Rossato et al., 2016; Seery, 2011). Threat evaluation reflects the perception of danger to one's well-being or self-esteem and low coping confidence, whilst challenge evaluation reflects confidence that the demands of a stressful situation can be overcome (Lazarus, 1991; Lazarus & Folkman, 1984). As such, cognitive appraisals antecede challenge and threat evaluations because if there is nothing at stake, an individual will experience neither challenge nor threat evaluations (Blascovich & Mendes, 2000).

The addition of challenge and threat evaluations is important for the prediction of affective states because both challenge and threat evaluations are associated with contrasting emotional responses. That is, challenge evaluation is associated with more positive emotions, and threat evaluation is associated with more negative emotions (Chadha et al., 2019; Jones et al., 2009; Meijen et al., 2020). Further, emotions are proposed to be interpreted as facilitative for performance in challenge, and debilitative in threat evaluations (Jones et al., 2009; Meijen et al., 2020). For example, research has demonstrated that greater threat evaluation to be associated with greater cognitive and somatic anxiety, and a more debilitative interpretation of anxiety, compared to challenge (Moore et al., 2012). Also, two reviews concerning challenge and threat (Behnke & Kaczmarek, 2018; Hase et al., 2019) have mainly focused on how challenge and threat influence performance. For instance, the systematic review by Hase et al. (2019) found challenge to be related to better performance than threat in 74% of the studies. In other words, individuals who exhibited challenge out performed individuals who exhibited threat. In addition, Behnke and Kaczmarek's (2018) meta-analysis provided more supporting evidence with challenge being related to successful performance. The results provided significant evidence that challenge and threat hemodynamics predicted successful performance. Therefore, challenge and threat evaluations are important antecedents to affective states and performance, alongside and in addition to cognitive appraisals and irrational beliefs.

1.2 | Limitations of previous research

Whilst Chadha et al. (2019) made theoretical contributions and advancements by incorporating cognitive appraisals, irrational beliefs, and challenge and threat evaluations to gain a greater understanding of the overall psychological experience of athletes' on approach to competitions, it was not without limitations. First, Chadha et al. recruited golfers across a wide range of handicaps, competing at different levels such as club, amateur and professional golfers. Also, the study adopted an experimental vignette methodology (EVM, see Aguinis & Bradley, 2014 for details), where participants were presented with vignettes that represented a real-life like scenario. Indeed, much of the research in golf has focused on golf putting within laboratory environments (e.g., Chamberlain & Hale, 2007; Wood et al., 2017; Woodman & Davis, 2008). Thus, the research was not conducted in an ecologically valid setting because data were not oriented around actual competition. This is an important limitation to address because evidence indicates a stronger relationship between irrational beliefs and affect when the stressor is real and present (Visla et al., 2016). Secondly, Chadha et al. (2019) did not assess athletic performance as an outcome measure. Thus, we do not yet know whether the model offered by Chadha et al. implicates performance or not. Lastly, the more notable limitation of Chadha et al. (2019) was that the study adopted an atemporal cross-sectional design. This shortcoming is pertinent because cognitions and affective states change in the lead up to important events (e.g., Skinner &

Brewer, 2002), and cognitive appraisals are considered to be iterative rather than static (Blascovich & Mendes, 2000; Schneider, 2008). Therefore, it is imperative for research to examine the tendency for cognitions and affective states to change in the lead up to an important event (e.g., Skinner & Brewer, 2002), and the iterative nature of cognitive appraisals.

1.3 | Temporal patterns of cognitions and affective states

The affective states of golfers are of particular interest due to the temporal space between performance epochs that manifest high within-person variation during the course of an 18-hole round (Lundkvist et al., 2021; Schantz & Conroy, 2009). But there are also temporal issues at play in the lead up to competition prior to the golfer setting foot onto the course. But the research pertaining to golf, and athletic performance per se, is bereft of studies that consider and measure the temporal patterning of affective states in the lead up to competition. Temporal research designs that naturally include repeated-measures are difficult to adopt with athletes, as access to suitable samples is not always possible at the level, frequency, and at the proximity to an event, that might be required. Nevertheless, some researchers have adopted longitudinal multilevel models or prospective designs to examine the temporal changes of antecedents to pre-competitive affective states (e.g., Martinent & Nicolas, 2017) and their association with sport performance during competition (e.g., Doron & Martinent, 2017). Researchers that have recognised the temporal nature of affective states (e.g., Cerin et al., 2000) broadly indicate that, on approach to competition, the intensity of somatic anxiety increases as competition nears, and then dissipates once the competition has ceased (Hagan et al., 2017b; Karteroliotis & Gill, 1987). In addition, cognitive anxiety increases as competition nears (Hagan et al., 2017a; Swain & Jones, 1993), or can remain stable over time (Gould et al., 1984; Marten, Vealey, et al., 1990). Other than anxiety, some attempts have also been made to analyse the temporal patterns of pre-competition affect (e.g., Cerin et al., 2001; Mellalieu et al., 2008; Robazza et al., 2000) and post-competition affect (e.g., Gaudreau et al., 2002; Wilson & Kerr, 1999).

In contrast, the temporal patterns of challenge and threat evaluations have been seldom examined, but one study in sport found that elite rowers, who were high in trait challenge evaluation, became more challenged across time through events of increasing magnitude (Cumming et al., 2017). Further, another study conducted among students, in the lead up to an academic exam, found that individuals with high trait threat showed increasing threat evaluation and negative affect as the exam drew closer, while challenge-trait individuals reported increased challenge evaluation and positive affect (Skinner & Brewer, 2002). Moreover, there exists one research that examined the temporal patterns of irrational beliefs in sport, where Turner and Moore (2016) found that baseline irrational beliefs were related to increases in emotional and physical exhaustion across an eight-week period. In conclusion, though investigation of temporal patterns of challenge and threat evaluations (e.g., Cumming et al., 2017) and irrational beliefs (e.g., Turner & Moore, 2016) in the lead up to an imminent competition has been conducted previously, nonetheless, the research is scarce and requires greater investigation and understanding of the nature of temporal changes for practitioners to provide effective support to athletes at different periods in the sporting season.

1.4 | The current research

In the current study, we examined temporal patterns of cognitive appraisals, irrational beliefs, and challenge and threat evaluations in the lead up to an actual imminent golf tournament over a fixed period of time at 1 week before (T1), the night before (T2), and an hour prior (T3) competition. In the previous studies (e.g., Chadha et al., 2019; David et al., 2005; Turner & Moore, 2016), irrational beliefs are considered to be central to the occurrence of negative affective states (hedonic balance and anxiety), but while cognitive appraisal and challenge and threat evaluations are considered as iterative (e.g., Meijen et al., 2020) and are likely to change in the lead up to an event (e.g., Skinner & Brewer, 2002), irrational beliefs are treated as static and stable (e.g., Turner & Moore, 2016). Therefore, in the current study, we incorporated analyses that treated irrational beliefs as both static and dynamic in nature, in order to increase the accuracy of predicting affective states. In line with the two main aims of the current study, it is hypothesised (H1) that baseline irrational beliefs (H1; static irrational beliefs) and increases in irrational beliefs (H2; dynamic irrational beliefs) will be associated with decreased cognitive appraisals, decreased challenge and increased threat evaluations, decreased hedonic balance (the relative amount of positive affect to negative affect; positive affect – negative affect), increased cognitive and somatic anxiety, and decreased facilitative perceptions of anxiety on approach to an actual tournament, and subsequent worse golf performance (e.g., Moore et al., 2012). In the current research, we focused on affective states of hedonic balance and anxiety, to adhere to previous similar research by Chadha et al. (2019) and to build upon this research by synthesizing the variables of positive and negative affect. Specifically, in the current study, we collapsed positive and negative affect into hedonic balance, because it is considered as a more suitable index of subjective well-being than measures of positive and negative affect when model predictions target the overall affective experience (Allen et al., 2017). Hedonic balance gives us a useful indicator of positive affect relative to negative affect. In addition, we recruited competitive elite golfers based on their handicap (Thomas & Overs, 1994) and eliteness criterion (Swann et al., 2015). We also assessed and took into account objective markers of performance (e.g., number of strokes). This integrative examination of how irrational beliefs influence cognitive appraisals across different timepoints is essential to inform the work of sport psychologists in implementing interventions with athletes on approach to an actual golf competition.

2 | METHOD

2.1 | Participants

One hundred and seven competitive elite Indian golfers (*Male* = 80, *Female* = 27; *M*age = 24.71 ± 6.18) with a golf handicap between 0 and 9 (*M*handicap = 1.28 ± 1.83) participated in the study. The sample size estimation was calculated using G*Power (Faul et al., 2007), indicating that for a medium effect size (f^2 = 0.15, $p < 0.05$) with a power of 0.80, a sample size of 85 participants was required. The golfers were recruited based on their handicap determined using Thomas and Overs' (1994) handicap criterion (highly skilled golfers have a handicap of 11 or lower), and the elite nature of the golfers was determined using Swann et al. (2015) elite criterion. Swann et al. (2015) classify athletes into four elite categories – semi-elite athletes, competitive elite athletes, successful elite athletes and world-class elite athletes. The eliteness score of the golfers was an overall average of 5.32 (±0.76), ranging from 4 to 6.67 level of expertise, thus classifying the current sample as competitive elite athletes. The participants had an average of 8.81 years (±4.72) golfing experience and were competing at an amateur (n = 46) and professional (n = 61) level. Further, participants competed at the national level competitions (n = 39) such as Indian Golf Union (IGU) and Professional Golf Tour of India (PGTI), while others competed at both national and international level competitions (n = 68).

No incentive was offered to the participants for taking part in the research. Ethical approval was granted from the University Ethics Committee and individual informed consent was obtained prior to data collection. The researcher approached golf organisations in India to recruit golfers. Further, word of mouth resulted in snowball sampling that helped in the recruitment of golfers.

2.2 | Measures

Irrational performance beliefs. The irrational Performance Beliefs Inventory (iPBI; Turner et al., 2018) was used as a performance specific measure of irrational beliefs. Within REBT theory and practice, beliefs are considered to be central to emotional and behavioural responses. REBT characterizes irrational beliefs to be tacit ideas that are rigid, extreme, illogical, and dysfunctional, and codifies this irrationality into four core irrational beliefs (demandingness, awfulizing, low frustration intolerance, and depreciation). On the other hand, rational beliefs are tacit ideas that are flexible, non-extreme, logical, and functional, codified into four core rational beliefs (preferences, anti-awfulizing, high frustration tolerance, and unconditional acceptance). Rational and irrational beliefs in REBT are externally valid concepts that encompass empiricism and logic. Beliefs that are not based on observable facts and that are inconsistent with reality are defined as irrational. In other words, irrational beliefs cannot be true because they cannot be proven, and break logical reasoning (Turner, 2022). REBT theory delineates what is rational and what is irrational, ideas that are at the foundation of the current paper. The iPBI comprises of 28-items that measures four core irrational beliefs of demandingness, awfulizing, low frustration tolerance and depreciation. The responses are made on a 5-point Likert-scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*) to a series of performance irrational belief statements that also provides a composite score. Cronbach's alphas in the current sample were 0.91 at T1.

Cognitive appraisals. The primary and secondary cognitive appraisals were assessed with five single-item questions used in previous research (David et al., 2002), modified from Smith and Lazarus (1993). The primary appraisal comprises of motivational relevance (MR; evaluation of the extent to which the encounter is relevant to one's goals) and motivational congruence (MC; evaluation of the extent to which the encounter is consistent with one's goals, 2-items), and the secondary appraisal comprises of problem-focused coping potential (PFC; evaluations of one's ability to act directly on the situation to bring it in accord with one's goals) and emotion-focused coping potential (EFC; evaluations of one's ability to psychologically adjust to the situation by altering one's interpretations, desires, or beliefs). The single-item questions were answered on an 11-point Likert-scale ranging from 1 (*not at all*) to 11 (*extremely*). A total cognitive appraisal score was obtained by calculating the mean score of all the items (e.g., Chadha et al., 2019). Higher total cognitive appraisal score indicates more positive appraisals.

Challenge and threat evaluations. The Challenge and Threat in Sport scale (CAT-Sport; Rossato et al., 2016), comprises 12-items representing two subscales with 7 items for challenge and 5 items for threat evaluations. The responses are made on a 6-point Likert-scale ranging from 1 (*totally disagree*) to 6 (*totally agree*) in anticipation of a competition. Cronbach's alphas were 0.84 for threat and 0.69 for challenge evaluations at T1, 0.83 for threat and 0.74 for challenge evaluations at T2, and 0.88 for threat and 0.72 for challenge evaluations at T3.

Affect. The Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) incorporates two 10-item subscales based on a bi-dimensional theory of emotion. Individuals can experience a mixture of positive affect (PA) and negative affect (NA) during a specific period of time (Watson & Tellegen, 1985). The items are scored on a 5-point Likert scale ranging from 1 (*very slightly or not at all*) to 5 (*extremely*). Cronbach's alphas in the current sample were 0.89 for PA and 0.77 for NA at T1, 0.90 for PA and 0.77 for NA at T2, 0.86 for PA and 0.84 for NA at T3. In the current study, we conceptualized positive and negative affect as hedonic balance (the relative amount of positive affect to negative affect; Allen et al., 2017). Higher hedonic balance scores indicate a greater tendency to experience positive affect.

Anxiety. The Competitive State Anxiety Inventory-2 (CSAI-2; Martens, Burton, et al., 1990; Jones & Swain, 1992) was used to assess the intensity and directional interpretation of cognitive and somatic anxiety symptoms at T1 only. Cognitive anxiety (CA) assesses the mental component of anxiety caused by negative expectations about success or negative self-evaluation and somatic anxiety (SA) is associated with the physiological or affective component of

anxiety. The items are scored on a 4-point Likert-scale ranging between 1 (*not at all*) to 4 (*very much so*) for intensity. Further, the directional interpretation of the anxiety symptoms was assessed using a single-item question on a 7-point Likert-scale ranging from −3 (*very negative/debilitative*) to +3 (*very positive/facilitative*). Cronbach's alphas in the current sample related to the intensity were 0.76 for CA and 0.76 for SA at T1.

To assess the intensity of cognitive and somatic anxiety at T2 and T3, the Mental Readiness Form (MRF) developed by Krane (1994) was used. The MRF offers a briefer assessment than the CSAI-2 (Martens, Burton, et al., 1990), which was important in the current paper due to repeated administration of measures that could burden the athletes. The MRF has two, bipolar 11-point Likert-scales that are anchored between 'worried' to 'not worried' for cognitive anxiety, and 'tense' to 'not tense' for somatic anxiety. In the current study we also included a directional scale similar to that of the CSAI-2, congruent with research suggesting that the directional scale is important when reporting athlete's perceptions of whether cognitive and somatic symptoms are facilitative or debilitative for performance (Jones & Hanton, 1996). The directional interpretation of the anxiety symptoms was assessed using a single-item question on a 7-point Likert-scale ranging from −3 (*very negative/debilitative*) to +3 (*very positive/facilitative*).

In the current study, the intensity of anxiety was measured using two different scales, which made it challenging to compare the means across the two measures. Therefore, the mean on one scale was transformed to an equivalent mean on the other using the following equation (Card, 2012):

$$X_2 = [(X_1 - \text{Min}_1)(\text{Max}_2 - \text{Min}_2)/\ \text{Max}_1 - \text{Min}_1] + \text{Min}_2$$

(Where, X_2 is the score on the second scale. X_1 is the score on the first scale that needs to be transformed. Min_1 is the lowest possible score on the first scale. Max_1 is the highest possible score on the first scale. Min_2 is the lowest possible score on the second scale. Max_2 is the highest possible score on the second scale).

Golf performance. An objective performance marker of competitive golf performance was collected from participants. Since the participants had different handicaps and competed in various competitions on different golf courses on different days, with divergent weather conditions, a standardized measure was created (termed Golf Performance Index; GPI). GPI is the net score minus competition scratch score (Neil et al., 2013), where the scratch score is a standard score allotted to an 18-hole golf course, and is the score that a scratch player (zero handicap) would be expected to shoot (see Freeman & Rees, 2009 for more details). Lower scores for GPI represent fewer numbers of strokes taken, and therefore represent a better performance (Neil et al., 2013). Further, scores from five previous competitions were also calculated and were averaged to give the equivalent of a one round score. Previous research (e.g., Krane et al., 1992) has suggested that standardised performance measures are more accurate because a specific performance can be compared to typical levels.

2.3 | Design and procedure

The current study is a within-subjects repeated-measures design in which competitive elite golfers approached an actual upcoming golf competition. Specifically, the study examined how irrational beliefs temporally relate to cognitive appraisals and challenge and threat evaluations to predict affective states (hedonic balance and anxiety) and in turn actual golf performance. The participants were contacted in the build-up to an important golf competition, and after giving consent, were invited to complete questionnaires about their cognitions and affective states in the lead up to the competition at three time points being; 1 week before (T1), the night before (T2), and an hour prior (T3) to competition. The three time points were adapted from Skinner and Brewer (2002) who conducted a similar study in an undergraduate student sample. At T1, participants completed measures of irrational beliefs, cognitive appraisals, challenge and threat evaluations, affect, and anxiety (using the CSAI-2). At T2 and T3, participants completed measures of cognitive appraisals, challenge and threat evaluations, affect, and anxiety (using the MRF). In the current research, the decision to administer two different anxiety measures was predominantly to not burden the athletes during the lead up to their competitions. Particularly, at T2 and T3 we did not want to take the participants away from their normal competition routine and engage them in a task that would require them to spend additional time pondering over statements. In addition, at T2 and T3 apart from MRF, participants completed measures of cognitive appraisals, challenge and threat evaluations, and affect. By including CSAI-2 at these two time-points the participants we would have undoubtedly overloaded the athletes with questions before their competition. Further, the completion of measures by participants at different time points was monitored by the researcher by contacting the participants at each time point and simultaneously checking online to ensure the participants completed the questionnaire at that exact time. This was made possible by the online survey platform that was used (i.e., Qualtrics) to circulate the questions. For some of the competitions, the researcher was also physically present at the golf competition location, which allowed us to further monitor data completion closely.

2.4 | Analytic strategy

Data for all the time points were examined for missing values using little's MCAR test, that demonstrated that the data across all time points was missing completely at random ($p > 0.05$) (T1, $\chi^2 = 87.03$, $df = 83$, $p > 0.05$; T2, $\chi^2 = 288.87$, $df = 270$, $p > 0.05$; T3, $\chi^2 = 130.02$, $df = 116$, $p > 0.05$). In the current study, we used the expectation maximisation (EM) method to estimate the missing values (i.e., resulting from golfers missing items in error) in line with the recommendations from Graham (2009), providing a complete data set for the main analyses. Further, in line with previous research (e.g., Smith, 2011) the data were examined for outliers, and data points with z scores greater than 2 were winsorized.

See Table 1 for descriptive statistics for all the variables across all the time points.

The main analyses were conducted in two stages. First, it was hypothesized (H1) that baseline irrational beliefs (static), would be associated with decreased cognitive appraisals, decreased challenge and increased threat evaluations, decreased hedonic balance, increased cognitive and somatic anxiety, and decreased facilitative perception of anxiety on approach to an actual golf tournament, and subsequent worse golf performance. Testing H1, cross-lagged path analysis of observed variables with autoregressive and cross-lagged paths was conducted (e.g., Curran et al., 2016), where all possible autoregressive paths were included alongside the temporal, cross-lagged, and additional direct effects of interest (see Figure 2). The average of five previous competitions scores was controlled for in the cross-lagged path analysis. In the current study, we evaluated the model fit using multiple fit indices suggested by researchers to achieve a comprehensive evaluation (e.g., Hooper et al., 2008) being the chi-square statistic (χ^2), comparative fit index (CFI), the standardized root mean square residual (SRMR), the root-mean-square error of approximation (RMSEA), and the RMSEA 90% confidence interval (CI). CFI provides an indication of how the theoretical model better fits the data in comparison to a base model constraining all constructs to be uncorrelated with one another. A non-significant χ^2 and CFI value of 0.90 or above is considered a good fit (Bentler, 1990; Hu & Bentler, 1998; Vandenbergh & Lance, 2000). SRMR value of <0.10 and <0.08 indicate good and acceptable fit, respectively (Kline, 2005; Wang & Wang, 2012). Further, a RMSEA value of < 0.06 indicates a close fit, whereas a value < 0.08 is also considered an acceptable fit (Browne & Cudek, 1993). Vandenbergh and Lance (2000) suggest that a cut-off value of 0.10 for RMSEA is acceptable. These fit indices were chosen over other indices as they are most insensitive to sample size, model misspecifications, and parameter estimates (Hooper et al., 2008; Kline, 2005).

Second, it was hypothesized (H2) that increases in irrational beliefs would be associated with decreased cognitive appraisals, decreased challenge and increased threat evaluations, decreased hedonic balance, increased cognitive and somatic anxiety, and decreased facilitative perception of anxiety on approach to an actual golf tournament, and subsequent worse golf performance. To eliminate auto-correlated errors and regression towards the mean effects addressing H2, hierarchical multiple regression analysis using residualised change scores were conducted (Zumbo, 1999) to determine to what extent changes in irrational beliefs predicted changes in dependent variables (i.e., cognitive appraisals, challenge and threat evaluations, hedonic balance, cognitive and somatic anxiety, and directional interpretation of anxiety). Positive residualised change score indicates an increase from T1 to T3 and a negative score indicates a decrease. Age, sex, and handicap were controlled for in Step 1, residualised change score for irrational beliefs was included in Step 2, predicting each dependent variable. In the final model, all residualised change scores of cognitive and affective variables were included in a regression analysis to predict golf performance.

TABLE 1 Mean scores and standard deviations of all variables at each time point.

	T1		T2		T3	
Variables	***M***	**SD**	***M***	**SD**	***M***	**SD**
Irrational beliefs	20.79	3.10				
Cognitive appraisals	8.73	1.16	8.75	1.16	8.73	1.11
Challenge evaluation	5.26	0.59	5.12	0.59	5.12	0.54
Threat evaluation	1.96	0.91	1.86	0.75	1.71	0.68
Hedonic balance	2.36	0.74	2.33	0.80	2.48	0.70
CA	1.84	0.47	1.85	0.67	1.74	0.58
SA	1.52	0.37	1.85	0.64	1.73	0.55
DI	1.77	1.14	1.86	1.05	1.66	1.17

Abbreviations: CA, Cognitive anxiety; DI, Directional interpretation; SA, Somatic anxiety.

3 | RESULTS

3.1 | Temporal effects of static irrational beliefs across time points (H1)

Cross-lagged path analysis was conducted with all variables at T1, T2 and T3, with all autoregressive paths included alongside temporal, cross-lagged, and direct effects of interest (Curran et al., 2016). The model fit to the data was acceptable, χ^2 (175) = 277.92, $p < 0.01$; CFI = 0.93; RMSEA = 0.07 [90% CI = 0.06, 0.09], SRMR = 0.09. However, with autoregressive paths as statistical controls, no significant temporal effects emerged. In sum, no causal relationships were seen between variables across the three time points.

3.2 | Temporal effects of dynamic irrational beliefs across time points (H2)

Hierarchical multiple regression analysis using residualized change scores were conducted to determine the extent to which changes in irrational beliefs, predicted changes in dependent variables (i.e., cognitive appraisals, challenge and threat evaluations, hedonic balance, cognitive and somatic anxiety, and directional interpretation of anxiety). The results indicated that irrational beliefs accounted for a significant proportion of variance in cognitive appraisal, (R^2 change = 0.07, F (1, 102) = 7.90, p = 0.01), threat evaluation (R^2 change = 0.05, F (1,102) = 6.00, p = 0.02), cognitive anxiety (R^2 change = 0.08, F (1,102) = 9.17, $p < 0.001$) and somatic anxiety (R^2 change = 0.08, F (1,102) = 8.91, $p < 0.001$), and directional interpretation of anxiety (R^2 change = 0.09; F (1,102) = 10.54, $p < 0.001$). Standardized coefficients revealed a significant positive association between change in irrational beliefs and change in threat evaluation ($\beta = 0.23$, $p = 0.02$), change in cognitive anxiety ($\beta = 0.29$, $p < 0.001$), and change in somatic anxiety ($\beta = 0.28$, $p < 0.001$). In other words,

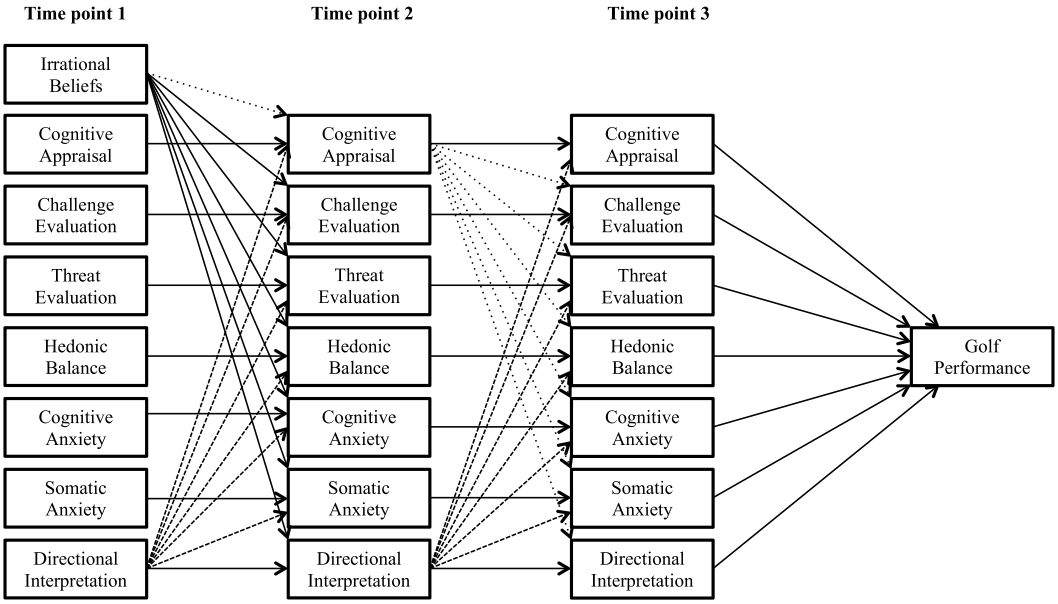

FIGURE 2 Proposed cross-lagged model of the cognitive appraisal model of affectivity (CAMA). The downwardly sloped dotted lines test for temporal effects. The upwardly sloped dashed lines test reciprocal effects. The other downwardly sloped lines test for additional direct effects. The horizontal paths are the autoregressive controls.

an increase in irrational beliefs was associated with an increase in threat evaluation and cognitive and somatic anxiety among golfers from T1 to T3. In addition, there was a significant negative association between change in irrational beliefs and change in cognitive appraisals ($\beta = -0.27$, $p = 0.01$) and change in directional interpretation of anxiety ($\beta = -0.31$, $p < 0.001$). In other words, increases in irrational beliefs were associated with decreases in cognitive appraisal and decreases in facilitative perceptions of anxiety from T1 to T3. Irrational beliefs did not account for a significant proportion of variance in challenge evaluation (R^2 change < 0.01, F (1,102) < 0.01, $p = 0.96$) and hedonic balance (R^2 change $= 0.01$, F (1,102) $= 1.60$, $p = 0.21$). Further, all the dependent variables (change scores) were included in a regression analysis to predict golf performance However, for objective golf performance, no dependent variables accounted for a significant proportion of variance.

4 | DISCUSSION

The main aim of the current study was to examine the temporal patterns of cognitive appraisal, irrational beliefs, and challenge and threat evaluations in predicting pre-competitive affective states (hedonic balance and anxiety) and golf tournament performance, among competitive elite golfers in the lead up to an actual golf competition. In the current research, we extended previous work (i.e., Chadha et al., 2019) by (a) examining change over time (temporal patterns) in cognitive antecedents to affective states in golfers (b) conducting this examination in an ecologically valid setting, (c) assessing objective golf performance, (d) sampling competitive elite athletes, rather than sub-elite athletes. In addition, we make theoretical contributions and advancements by providing a more comprehensive picture of how cognitive factors act as interactive antecedents to affective states in the lead up to actual competitive performance. In the current study, we also treated irrational beliefs as both static and dynamic in nature, providing an elaborate insight into the dynamic cognitive appraisal process among golfers in the lead up to competition.

Firstly, it was hypothesized (H1) that baseline irrational beliefs (static), would be associated with decreased cognitive appraisals (i.e., more negative), decreased challenge and increased threat evaluations, decreased hedonic balance, increased cognitive and somatic anxiety, and decreased facilitative perception of anxiety over time on approach to an actual golf tournament, and thus would be subsequently predictive of worse golf performance. However, using crossed-lagged path analysis the current study did not find causal effects for irrational beliefs when treated as a static variable on any of the other variables across the three time points (H1).

Secondly, and in contrast, treating irrational beliefs as dynamic and subject to change temporally over short periods of time, it was hypothesized (H2) that increases in irrational beliefs would be associated with decreased cognitive appraisals (i.e., more negative), decreased challenge and increased threat evaluations, decreased hedonic balance, increased cognitive and somatic anxiety, and decreased facilitative perception of anxiety on approach to an actual golf tournament, and thus would be subsequently predictive of worse golf performance. We found that an increase in irrational beliefs was associated with an increase in threat evaluation and cognitive and somatic anxiety. Also, increases in irrational beliefs were associated with decreases in cognitive appraisals (i.e., became more negative) and decreases in facilitative perceptions of anxiety.

The finding that static irrational beliefs did not predict temporal effects (via cross-lagged path analysis), while changes in irrational

beliefs (dynamic) predicted changes in cognitive appraisals, threat evaluation, cognitive and somatic anxiety, and the directional interpretation of anxiety, might support Ellis' assertion concerning the embodiment of emotion (Ellis & Ellis, 2011). That is, cognitions, emotions, and behaviours are not disparate, but they are interconnected and interrelated with each other (Ellis, 1994; Turner, 2022). So, rather than viewing relationships between the variables as cause and effect, it is possible that the variables are thoroughly interconnected with one another. In other words, beliefs, emotions, and behaviours appear to be deeply interrelated such that when one variable moves (e.g., hedonic balance, anxiety, and directional interpretation of anxiety), so do the other variables (e.g., irrational beliefs, cognitive appraisals, and challenge and threat evaluations) symbiotically. Therefore, the use of temporal design in the current research demonstrated a closer association between cognitive appraisals, irrational beliefs, challenge and threat evaluations, and affective states, than what could be determined using atemporal cross-sectional data, such as that used by Chadha et al. (2019).

In current study, the finding that an increase in irrational beliefs was associated with decrease in cognitive appraisal and increase in threat evaluation might also offer a parallel to the binary theory of emotional distress developed by Ellis and DiGiuseppe (1993). The current research goes beyond the binary theory of emotions and considers emotional consequences through a different binary construct namely challenge and threat evaluations. The revised theory of challenge and threat states in athletes (TCTSA-R; Meijen et al., 2020) reflects a polychotomy of high challenge, low challenge, low threat, and high threat evaluations. Irrational beliefs and cognitive appraisals are implicated in the experience of challenge and threat evaluations, such that greater irrational beliefs and lower cognitive appraisals (i.e., more negative) will more likely create high threat evaluation. As a result of threat evaluation, athletes are more likely to experience negative affect and interpret it as more debilitative for their performance. Thus, the findings of the current study are to some degree in line with the recent postulations of the TCTSA-R, and also with previous research indicating that higher irrational beliefs are associated with greater threat evaluation (Chadha et al., 2019; Dixon et al., 2017; Mansell, 2021). Whilst the TCTSA-R indicates a polychotomy, we do not measure challenge and threat evaluations in this manner in the present study. Instead, we measure challenge and threat evaluations as two separate, but related constructs. As such, one can be high in both, low in both, high in one and low in the other. Therefore, the extent to which the current study is true a test of TCTSA-R is limited.

On the other hand, change in irrational beliefs was not associated with change in challenge evaluation. The lack of association between irrational beliefs and challenge evaluation is in support with previous research where no association was found between irrational beliefs and challenge evaluation (e.g., Chadha et al., 2019). This could be due to the fact that in the current study, we did not measure rational beliefs alongside irrational beliefs (as a sport specific measure does not exist), which is important because low levels of irrational beliefs do not necessarily indicate high levels of rational beliefs (Bernard, 1998).

With regards to performance, change in irrational beliefs was not associated with change in objective golf performance, a finding similar to Allen et al. (2017) where irrational beliefs were unrelated to objectively measured academic performance. Since the objective golf performance is the final outcome of a competition, it might have been unsuccessful to capture the complexity of what essentially constitutes golf performance, hence, making it a difficult component to accurately evaluate. Therefore, the role of irrational beliefs in an actual skilled performance remains in need for additional research.

4.1 | Practical implications

The findings of the current research provide useful recommendations for sport psychology practitioners. The temporal changes indicated that sport psychologists should consider the dynamic nature of antecedent cognitions and affective states in the lead up to competition, and ensure that at specific time points golfers are provided with sufficient and structured support. The findings of the current study established that change in irrational beliefs was associated with change in cognitive appraisals, threat evaluation, cognitive and somatic anxiety, and directional interpretation of anxiety. Therefore, practitioners may wish to apply REBT with athletes to challenge their irrational beliefs, particularly to prevent irrational beliefs from increasing in the lead up to competition, in order to curtail increases in threat evaluation and anxiety. Also, based on the current findings, there might be a bi-directional or reciprocal relationship between beliefs and emotions, rather than the unidirectional cognitive mediation model often portrayed in CBT (see Longmore & Worrell, 2007, for a discussion). Specifically, the literature concerning REBT applied to golf is burgeoning, but whilst there is evidence that indicates that changes in irrational beliefs can bring about reductions in anxiety (e.g., Turner et al., 2020), it might be possible to reduce irrational beliefs by decreasing anxiety with the help of palliative methods such as progressive muscle relaxation technique (Ellis, 1994).

4.2 | Limitations and future research directions

Despite the strengths, the current study is not without limitations. The primary limitation is that in the current study we used self-report measures, which can result in biases when investigating cognitive appraisals (e.g., Paunonen & LeBel, 2012). In addition, to make the frequent collection of data over different time points feasible and to reduce the burden on participants, shortened versions of some measures were administered. For instance, in the current study, we were only able to collect data for irrational beliefs at T1, because of the length of the questionnaire (iPBI, 28-items). Thus, future research will benefit from a shorter measure of iPBI that would allow us to collect irrational beliefs data at each time point to better capture the dynamics of this variable.

Similarly, the intensity of anxiety was measured using two different measurements was not ideal from a research perspective, but was a reasonable adjustment given the nature of the design we adopted. Further, to assess the directional interpretation of anxiety in the current study we used a single item, and as such, findings concerning facilitative versus debilitative perception of anxiety in the current study should be viewed cautiously and expanded upon in the future. To overcome the limitations of self-reports, future research using temporal designs could investigate emotional experiences using physiological markers (e.g., heart rate, systolic blood pressure and diastolic blood pressure, see Wood et al., 2018) and behaviours or movements by employing kinematics and muscle activity measures (see Moore et al., 2012).

In the current research, golfers completed measures regarding their cognitions and affective states (hedonic balance and anxiety) at T3 that was connected to golf performance (i.e., data collected immediately post competition) in the cross-lagged path analysis. This should be considered as a limitation because in the current study we did not measure cognitions and affective states during actual play that might have been more relevant and associated to golf performance. Therefore, future research will benefit from measuring cognitions and affective states during actual play where athletes can be requested to reflect and recall their cognitions and emotions after completing the first nine holes and then after completion of the round (e.g., Martens, Vealey, & Burton, 1990). Future research can also collect data during a round of golf where each participant is provided with a mini-booklet consisting of 18 pages (one for each hole) and requested to provide a brief narrative around their thoughts, emotions, and objective performance variables (Neil et al., 2013). In addition, a Think Aloud (TA) protocol can be used for continuous monitoring of data, where the participants constantly report their thoughts during their round. For instance, Whitehead and Jackman (2021) captured cognitive processes of competitive golfers throughout their actual play using the TA method. Future research should also consider measuring coping responses used to manage pre-competitive emotions (e.g., Britton et al., 2019) using The Coping Inventory for Competitive Sport (CICS; Gaudreau & Blondin, 2002), as athletes might already possess successful coping mechanisms to mange pre-competitive cognitions and emotions from impacting their performance. Also, future research should consider investigating the current phenomenon among elite athletes across different sports and populations.

5 | CONCLUSION

In conclusion, the results of the current research established that change in irrational beliefs was associated with change in cognitive appraisals, threat evaluation, cognitive and somatic anxiety, and directional interpretation of anxiety in the lead up to competition. Specifically, an increase in irrational beliefs among golfers resulted in an increase in threat evaluation and cognitive and somatic anxiety, and increased in debilitative perceptions of anxiety among golfers. The temporal data collection and the findings of the current research indicated that practitioners should consider the dynamic nature of cognitions and affective states in the lead up to competition, and intervene and implement strategies at specific time-points to enable golfers to approach pressured situations adaptively.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data supporting the findings of this study are available from the corresponding author on request.

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